Volkswagen Cabriolet DIY Guide
Adjusting the Timing

There are three timing methods listed in this how-to. Read through them all and determine which method is best for you and your car. It is best to use a timing light (method 1), but the static timing methods can be just as effective.

Method 1

This how-to was originally posted on VWvortex.com by "Black_cabbie": http://forums.vwvortex.com/zerothread?id=1660502 (the VWvortex how-to contains an error which has been corrected in this how-to, seen in green).

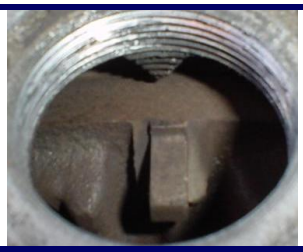
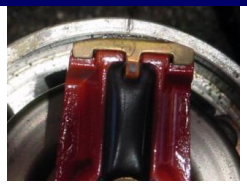
Tools needed:

- Timing light
- Various wrenches
- Flathead screwdriver

The camshaft pulley has 2 important marks on it: A little notch on the engine side and an OT mark on the other side.

The flywheel has 2 marks as well: One V-shaped notch showing 6° BTDC (**B**efore **T**op **D**ead **C**enter) and a little circle showing TDC (**T**op **D**ead **C**enter).

The distributor has a notch to where the rotor should be aligned.

Steps	Photos
1. Remove the timing hole plug (big, round green or white thing) on the transmission. 2. Remove the spark plugs and distributor cap. 3. Turn the engine BY HAND (i.e., use a wrench on the crankshaft bolt) until you see this mark on the flywheel. The little O mark (white arrow) on the flywheel is the TDC mark. It means the #1 piston is in the TDC position and both inlet and outlet valves are closed (maximum compression in the chamber); that means that the spark plug is supposed to fire when the piston is at that point. The 6° BTDC mark is indicated by the yellow arrow.	
If you are not sure about the flywheel, insert a long screwdriver into the #1 cylinder through the spark plug hole and, while slowly turning the engine, check to see if the screwdriver is moving. That will give you an idea if the piston is at TDC. (The picture at right shows a flywheel timing lug, which is used with a special Volkswagen timing tool; this is ***not*** a BTDC mark).	
4. Go to the distributor and check if it points to the little notch. If it doesn't you have to loosen the belt, get it off the camshaft pulley and turn the rotor by hand until it points to the notch. Put the belt back on and make sure the rotor doesn't move.	

5. Now check the camshaft pulley marks. (If you have a late Digifant engine you have a plastic cover, which doesn't allow you to see any marks on one side of the pulley.)

So you have the OT mark (Digifant) which is supposed to align with the mark on the plastic cover. This mark is in the top center of the plastic cover. There is also a little arrow pointing down. The mark on the pulley should be under this arrow. If it's not you have to loosen the belt again and turn the camshaft until the marks align. Make sure you don't move the distributor rotor! The angle is a bit funny.... I know. It's supposed to be right under the arrow.

If you have an older CIS engine you probably have the metal belt cover, which exposed both sides of the crank pulley. You should be able to see the timing mark: a dimple, notch or painted dot. This mark is supposed to be level with the valve cover (top of the gasket flange, under the hold-down bars).

6. Tighten the belt tensioner according to specs and make sure the belt is not too tight. You should be able to twist it by hand 90°. No more, no less.

The cam timing is finished. You have adjusted everything to VW spec, which is 0° advance for the camshaft.

7. Adjust the ignition timing (you'll need a timing light to fine tune it). If you don't have one you can do it by "feeling" the engine.

So, suppose that everything is correct: all the marks are aligned and you have tuned the engine a couple of times BY HAND to see if anything interferes. Everything should be okay. If it is, put the distributor cap on and start the engine. Normally, the engine should start immediately.

Take your timing light (if you have one) and point it into the gearbox hole where the flywheel is. If you have a Digifant motor, unplug the blue coolant temp sensor and rev the engine 3 times over 3k to clear the ECU memory. Have someone hold the engine at 2250 RPM and observe the mark in the hole as the engine turns and the light flashes. Timing CIS engines should be done at idle speed (850-900 RPM) and all the accessories should be off. The timing light will flash only when the #1 spark plug is fired, which is when the piston it at Top Dead Center; meaning the little notch on the flywheel should appear still.

If it doesn't appear, loosen the 13mm nut on the distributor and slowly turn the whole distributor while still keeping the revs at 2250 (idle speed for CIS). As you turn it you will probably hear the engine sound change. You will also "feel" the engine running rough or smooth. Normally, as you get closer to the notch the engine should feel smoother, with no misfires and with higher, cleaner RPM. Turn the distributor until you get the little notch in the center of the hole. That's the 6° BTDC timing everybody has been talking about and where your engine is supposed to produce its peak power (if it's standard).

Once you are happy with the timing, tighten the 13mm nut on the distributor again and check once more that everything is still okay: Plug the CTS sensor back in (Digifant) and rev it 3 times again over 3K; let it idle and observe. Chances are your idle might need some adjusting to get it to around 850-900 RPM.

That's it! You did it! You can now brag to your friends that you don't need a specialist to do it!

Method 2

This how-to was originally posted on VWvortex.com by "tolusina": http://forums.vwvortex.com/zerothread?id=3281138 .

It is more accurate and far simpler to time with a strobe light (strobe is preferred). This static method gets close enough to get an engine running and very much drivable. For some do-it-yourselfers it will be good enough as-is for many thousands of miles.

The Hall generator signal is an on/off signal much like points. The shutter wheel inside the distributor has four apertures (windows). When the aperture is open, allowing both sides of the Hall pickup to "see" each other, the Hall signal voltage on the green/white wire is at zero. As the Hall "window" closes the Hall pickup path, the Hall signal voltage on the green/white wire goes high to approximately 10 VDC. This spike is the signal the Hall control uses to release the coil ground at terminal 1. This is **THE** moment we're looking for!! We can use it just like was done in the days of points and test lights (we do want a DVOM or LED tester - not a bulb type - though).

Important notes: Points and condenser ignition have a rising edge, or rising voltage at terminal 1 on the coil (green wire) as the points open (the moment of ignition). Digifant and CIS-E with knock sensor *(editor's note: Cabriolets were not factory-equipped with CIS-E)* also have a rising edge on the green/white Hall generator signal wire (this means there will be a voltage spike). CIS-Lambda has a falling edge on the green/white Hall generator signal wire (this means there will be a voltage drop).

Tools needed:

- DVOM (digital volt-ohm meter) with a VDC scale to at least 11 volts
- Socket wrench for crank pulley bolt
- Flathead screwdriver
- For double vacuum advance chamber distributors: MityVac (or similar vacuum tool)

1. Remove the distributor cap. We don't want this engine to inadvertently start; we also want to see when the rotor points to the #1 notch.
2. Prepare to turn the engine by hand: a socket on the crank pulley bolt; well adjusted V-belts; a screwdriver in the alternator fan blades, or a wrench on the alternator fan bolt; my preference is 5th gear with the park brake off and roll the car.
3. Connect your DVOM to the green/white signal wire from the Hall generator and switch it to a VDC setting between 11 and 20.
4. Turn the engine clockwise (same as normal running rotation), until the rotor *approaches* the #1 notch.
5. Now, slowly creep up to the notch watching the voltage indicator closely.
    a. **Digifant & CIS-E**: As soon as the voltage suddenly spikes from 0 to 10 VDC, **STOP**!
    b. **CIS-Lambda**: The voltmeter should read 11 VDC as the 6° BTDC mark approaches the bell housing pointer. As soon as the voltage suddenly drops from 11 to 0 VDC, **STOP**!
6. Check the timing marks:
    a. If you are at or very near the 6° BTDC mark, you're done.
    b. If things aren't lined up just yet
    c. If things don't line up just yet, bring the crank timing marks together (ALWAYS turn the crank in the running direction as you check; if you overshoot, overshoot backwards an 1/8th turn or so, then creep back clockwise). Crank marks lined up now? Good! Loosen the distributor base clamp and rotate the distributor body watching the voltage indicator for the voltage spike to 10 VDC. When you've got it, tighten the clamp. Visually, viewed clockwise from the top, the Hall window should have just closed. If you get the opposite slope, the car is guaranteed to run awful, if at all. Repeat backing the crank up 1/8th turn then creeping back to the timing marks until the voltage spike is as perfectly synchronized to the timing marks as possible.

I just tested this procedure on my Digifant I car. The marks were very close to where they were set with a timing light at 2,000 RPM and blue coolant temp sensor disconnected.

CIS engines should take to this just as well. Early, double vacuum advance chamber distributors require an additional step. The double vacuum advance chamber distributors require manifold vacuum applied to the rear, flat chamber when timing with a strobe light. The static method above also requires that that vacuum chamber be operating. A MityVac or similar vacuum tool is the most obvious choice: Attach the MityVac hose to the rear, flat chamber and apply vacuum. Re-check frequently that vacuum is holding as you time. You want to use the -3° timing mark (3°ATDC).

5:13 PM 1-14-2009) **kamzcab86:** I'm editing the static timing DIY guide again (thanks to your helpful post in Erik's thread) and need clarification: If the distributor requires rotation on CIS-Lambda after the cam/crank sync, are we still looking for a voltage spike while it's being turned, or is it a voltage drop?

(8:28 PM 1-14-2009) **tolusina:** I need to re-write that whole thread/posts, even I get confused reading it, and I wrote it. It really turned into a jumble.

(8:33 PM 1-14-2009) **tolusina:** Best I can answer your question at the moment, if I understand your question correctly (your question being based on my jumble), the engine must be rotating clockwise, the same direction it runs, simultaneous with the arrival of the +6° timing mark at the bell housing pointer, the Hall signal should go LOW, CIS lambda static timing is now set. CIS-E with knock sensor and DigiFant go HIGH as the +6° mark arrives.

(8:34 PM 1-14-2009) **tolusina:** Points go HIGH at coil terminal #1 at -3° with vacuum applied to the back chamber of the vacuum advance unit.

(8:35 PM 1-14-2009) **kamzcab86:** Right, I got that part. It's this part, when things aren't quite lined up yet: "Crank marks lined up now? Good! Loosen the distributor base clamp and rotate the distributor body watching the voltage indicator for the voltage spike to 10 VDC. " Is that for both CIS and Digi?

(8:37 PM 1-14-2009) **tolusina:** I'm not positive on this one, but I seem to recall that some early Hall equipped Rabbits had the two chamber vacuum advance unit, timing on those is set at -3° with vacuum applied on the rear chamber, same as on points distributors with two chambers, Hall voltage goes LOW, same as other CIS lambda cars.

(8:40 PM 1-14-2009) **tolusina:** There's what I really haven't figured out how to explain. The direction the distributor needs to be turned is one way (and I forget which way) if the timing is advanced from spec and needs to get retarded to get to spec.
The distributor will need to be turned the opposite direction if the timing is retarded from spec and needs to be advanced.

(8:40 PM 1-14-2009) **tolusina:** I'm thinking.....

(8:45 PM 1-14-2009) **tolusina:** Back to the beginning. The write up really needs to be written with at least two (three would probably be better) completely separate sections, one for falling edge (CIS lambda) with a sub section addressing the dual vacuum chamber distributors, a second section addressing CIS-E with knock sensor and DigiFant, the rising edge versions, and a 3rd section addressing points with a sub section covering the dual vacuum chamber units.

(8:50 PM 1-14-2009) **tolusina:** CIS lambda, because that's the one you are most familiar with, if, as +6° arrives, the voltmeter has not dropped yet, the timing is 'late', or 'retarded'. (I'm pretty sure, I'm getting a headache trying to picture this part) the distributor body must be rotated counter clockwise to move the Hall pickup relative to the shutter wheel and cause the Hall signal to drop.

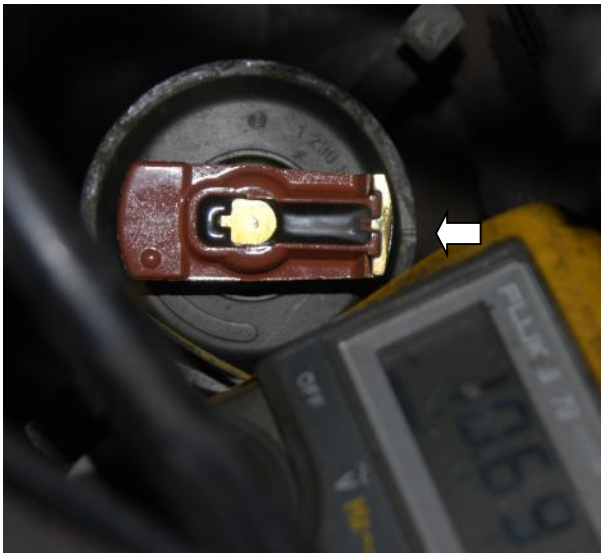
(8:51 PM 1-14-2009) **tolusina:** If the voltmeter drops BEFORE +6° arrives, timing is advanced, rotate the distributor clockwise to correct.

(8:54 PM 1-14-2009) **tolusina:** Once the distributor has been turned for correction, the crankshaft must be rotated back an 1/8th or 1/4 turn, then brought back to +6° (taking up 'slack' or 'backlash') and the timing re-checked. Every adjustment requires the reverse and forward step for accurate settings.

(8:55 PM 1-14-2009) **tolusina:** This is good, if it's correct, it's most of one part of the re-write.

(8:57 PM 1-14-2009) **tolusina:** Princess' timing is probably spot on with a strobe, yes? If so, check it with the static method, you'll see how close static is. Brian and Katherine both like the static method and have more or less endorsed it, and we both know that AtomicAlex is one sharp cookie.

In this first photo, the rotor, turning clockwise, is approaching the #1 timing notch on the distributor body (white arrow); the shutter aperture is open in this position and voltage on the green/white wire is LOW.



In this photo, the rotor tip has just lined up with the notch on the distributor body; the aperture is closed and voltage has gone HIGH. This is the moment the Hall generator signals the Hall control unit.

An old photo showing the shutter wheel position as the rotor lines up with the notch.

CIS shutter wheel.

The guys at Vintage Watercooleds have a write up about Rising Edge vs. Falling Edge as referencing Hall ignition signals, including a very nice photo: http://www.vintagewatercooleds.com/tech/2008/megasquirt-igniton-rising-edge-vs-falling-edge/ .

Method 3

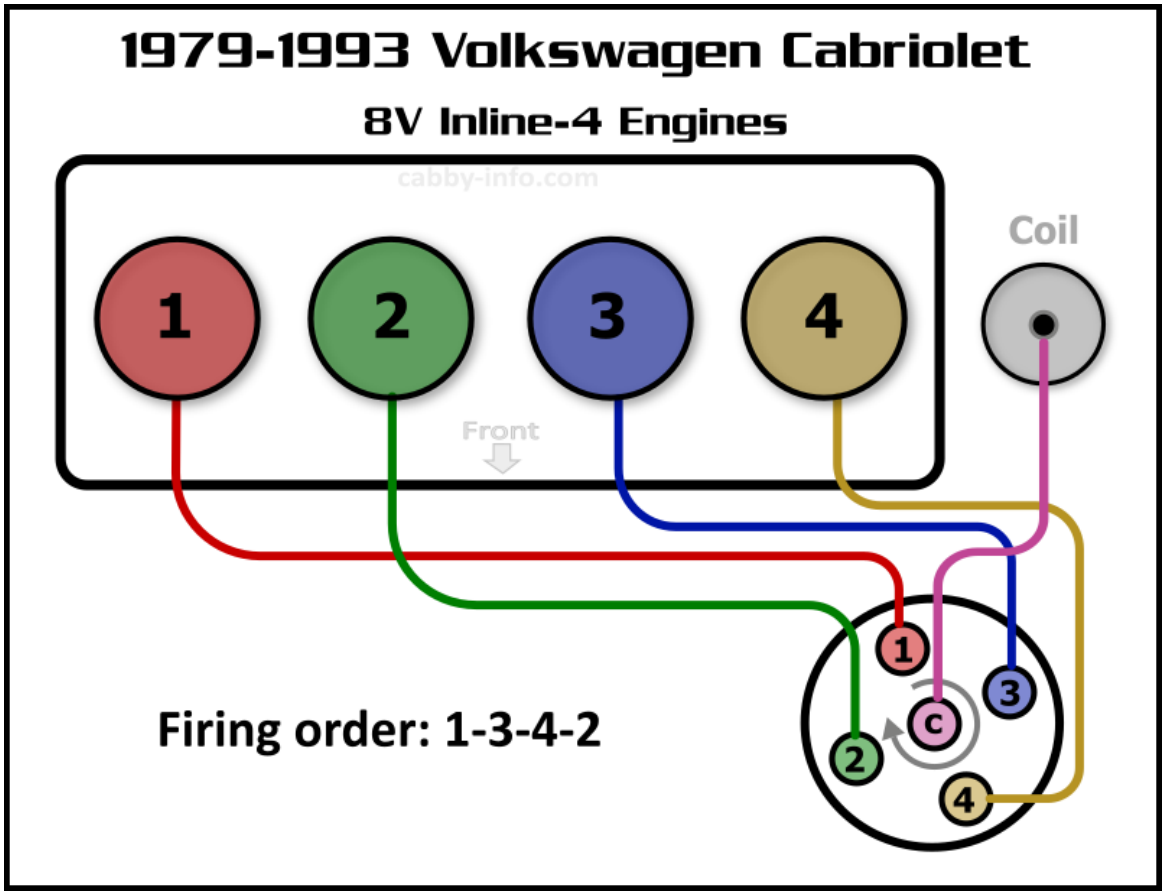
This method is courtesy of Bad Habit Rabbit: http://www.geocities.com/jonnyguru/vw/ .

"All of your VWs have marks on the rotating parts to denote 0° TDC. The cam has a dot that lines up with the valve cover. The flywheel has a notch that lines up with the center of the hole on top of the bell housing. The distributor has a slash that lines up with the rotor. Line all of these up and your car is at 0. No advance. No retard.

In a pinch, I've put the car in 5th gear (with the car off!) loosened the distributor and pulled the car forward until the advance mark on the flywheel appeared in the little timing hole. I then turned the distributor until the hash mark lined up with the rotor and tightened her down. If your flywheel notch is at 3° or 5° or whatever, now your distributor is at 3° or 5°. It's probably good for keeps or at least until you can get your hands on a timing light, but it DOES work accurately!"

Firing Order

Be sure your plug wires are re-connected properly!



* * Remember, **you** are responsible for working on **your** car; Cabby-Info.com, "Black_cabbie", "tolusina", "Bad Habit Rabbit", VWvortex.com, VAG, VWoA, or anyone else are not responsible if **anything** goes wrong while **you** are working on, in and under **your** car! Use this information at your own risk!* *